MULTILEVEL ANALYSIS OF FACTORS ASSOCIATED WITH CHILD MORTALITY IN UGANDA

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DECLARATION

I, Alex Mugarura, hereby declare that the work I have presented is solely the result of my efforts (except where quoted) and that it has never been submitted before by any one for the award of the degree at any university or institution of higher learning.

Signature Date

…….. ……..

Alex Mugarura

APPROVAL

This dissertation has been submitted with the approval of the internal supervisor:

Signature Date

…….. ……..

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Institute of Statistics and Applied Economics

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DEDICATION

This work is dedicated to my lovely parents Mr Annania Byamaka and Mrs Jadress Byamaka and My lovely wife Sarah Tumuramye Kyensi for all their efforts and words of encouragement towards my education. May the Lord God reward them with good health and life.

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ABSTRACT

The purpose of this study was to examine the effect of factors associated with child mortality in Uganda. Demographic and Health Survey data for 2006 were used to investigate these factors. This data set had a hierarchical structure. To account for this nested data, a hierarchical / random regression model was fitted to find the significant factors affecting child mortality.

Sex of a child, duration of breastfeeding, birth weight, Education level, age of mother, household wealth were found to be important predictors of child mortality in the two models. However, controlling for mother level factors in model one, the within childhood characteristics were seen to be highly correlated. In a concept from an explicit multilevel analytic framework, the study demonstrated that individual (child) and mother level characteristics are independent predictors of child mortality, and that there is significant variation in odds of reporting child mortality, even after controlling for effects of both individual- and mother-level characteristics.

Results as by the Standard Logistic regression model (model II) were almost the same as the results by the random effects model (model I). However, the p - values in the random effects model were small compared to the p – values of a standard logistic model. Hence the random effects model are more statistically significant than those in a standard logistic regression model due to its lack of independence within variables.

In this setting, random effects regression model is recommended as an appropriate alternative to standard logistic regression to account for variations due to a hierarchical structure in the data used in this study.

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ABRREVIATIONS

ANC	Antenatal Care
DHS	Demographic Health Surveys
EBF	Exclusive Breast-feeding
IMR	Infant Mortality Rate
MDG	Millennium Development Goals
STIs	Sexually Transmitted Infections
UBOS	Uganda Bureau of Statistics
UDHS	Uganda Demographic Health Survey
UN	United Nations
UNICEF	United Nations I international Children Emergence Fund
U5MR	Under 5 Mortality Rate
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

One of the demographic variables that affect population trends is mortality. The mortality of the children is of interest to demographers, policy makers and researchers because it is one of the indicators of socio-economic development. In spite of improvements in the health and well-being of populations globally over the last few decades, factors such as infectious and parasitic diseases and malnutrition persist as the major obstacles to the improvements in infant and child mortality in many developing countries.

World Health Organization (WHO), 2004 reported that 10.8 million children under age five die every year. Four million of those children die within the neonatal period (1^{st} month of life). In Kenya, studies on child health have focused on medical causes of infant and child mortality (McElroy et al, 2001). These authors revealed that newborn' health is closely linked to that of their mothers. Therefore, newborn babies have unique needs that must be addressed in the context of maternal and child health services.

According to UNICEF (1999), the decline in child mortality in Africa has been slower since 1980 than in the 1960s and 1970s. Of the thirty countries with the world's highest child mortality rates, twenty-seven are in sub-Saharan Africa. Through the provision of better healthcare services, infant and under-five mortality rates have declined from 129.1 and 147.2 to 84.7 and 82.9 deaths per 1,000 live births, respectively over the decade (Binka et al, 2007). Although the situation is much better than it was a decade ago the level of childhood

mortality is still quite high. Therefore disentangling the effects of environmental and socio-demographic risk factors of mortality could lead to a better understanding of the forces underlying childhood mortality and help child survival intervention program managers to prioritize and target children who are at most risk. We also exploit the richness of these data to show the influence of migration and seasonality

In 2006, 9.7 million children under five died and that is a 60% decline since 1960 (UNICEF, 2008). About half of the child deaths occur in Africa. According to UNICEF (2006) and UBOS (2006), Uganda had higher rates of U5MR that is 137 per 1000 live births compared to her counterparts in the sub-Saharan region (Tanzania had 119 deaths per 1000 live births, Zimbabwe with 105 deaths, Kenya had 121 deaths, Botswana 124 deaths per 1000 live births).

The mortality of children is of importance to demographers, policy makers and researchers as mentioned earlier; it is a sensitive indicator of social and economic development of a country and shows evidence of its priorities and values. Therefore, investing in the health of children and their mothers is not only human rights imperative, it is a sound economic decision and one of the surest ways for a country to set its course towards a better future. Impressive progress has been made in improving the survival rates and health of children even in some of the poorest countries since 1990.

If Uganda is committed to achieving the MDG on child mortality and to improve child health, there is need to understand clearly the factors that are contributing to child mortality and the need to examine the effect of child and mother characteristics on child survival.

1.2 Problem statement

Current child mortality levels show that one in every thirteen Ugandan children die before reaching first birthday and one in every seven children does not survive to the fifth birthday (UBOS, 2006). Despite numerous interventions and efforts regarding primary health care, health education, extension of health services by government, private sector, non-governmental organizations all intended to improve the lives of children in Uganda; the lives and health situations of these children has remained poor compared to other neighbouring countries.

Demographic and health survey data as used for child mortality analysis have a hierarchical structure. A multilevel analysis also referred to as a hierarchical model can account for the lack of independence across levels of nested data. Conventional regression assumes that all experimental units are independent in the sense that any variable affecting child mortality has the same effect in all families. A multilevel modelling relaxes this assumption and allows these variables' effects to vary across the families. Therefore this study explores the hierarchical structure at child and mother unit levels of analysis and examines the effect of mother characteristics on childhood mortality.

1.3 Objectives of the study

The main objective is to critically examine the factors associated with child mortality in Uganda using a hierarchical or multilevel regression model. Specifically, the study is intended to:

1. Examine the effect of childhood factors on child mortality.
2. Examine the contribution of mother factors on child mortality in Uganda.

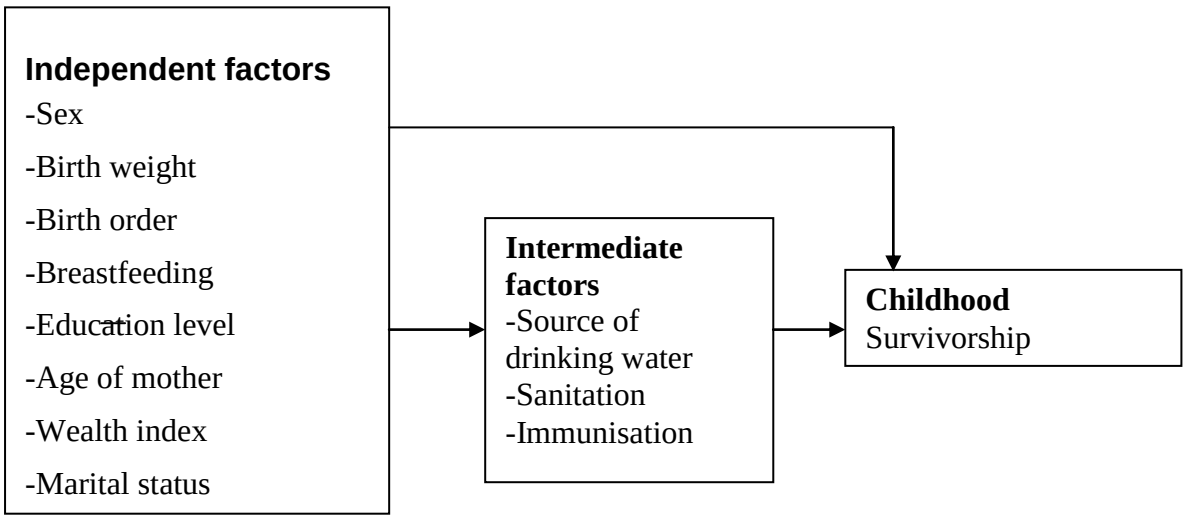
1.4 Hypotheses

1. The mothers' age has no effect on childhood mortality.
2. The mothers' education level has no effect on childhood mortality.
3. The household wealth status has no effect on childhood mortality.
4. The weight of a new born baby has no effect on child mortality.
5. Breastfeeding has no effect on childhood mortality.

1.5 Conceptual framework

The conceptual framework is based primarily on one developed by Mosley and Chen (1984). This model provided for the measurement of morbidity and mortality in a single variable and it organizes factors associated with infant and child mortality into proximate and background determinants. The model allows for careful tracing of the pathways through which socio economic factors impinge on child health and survival in the developing world.

Fig 1.1 A conceptual framework for the study of under-five mortality in Uganda



Modified from Mosley and Chen (1984)

Maternal factors like maternal education as in the literature review, increases mother level of knowledge and skill to effectively use resources at her disposal. Further, the advantage of good hygienic conditions for example toilets and medical facilities too increase survival chances of children (Caldwell, 1979).

Education also increases age at first birth as it does not encourage girls to be involved in child bearing hence they start at an older age and this leads to producing few children which increases the chances of survival of the children. Education also enables the mother to know information on family planning methods, plan for the family and to be in a better environment. All these determine the survivorship of the children.

Furthermore, income of the mother influences environmental conditions like having protected water sources such as taps and better toilet facilities, better and spacious housing hence affecting under five mortality levels in the home and these environmental conditions vary across homes due to different levels of occupation.

Women's access to income helps them to provide facilities that enhance better sanitary conditions. These are facilities like adequate rooms, cemented floors, clean and adequate water sources and good toilet facilities. Crowded sleeping conditions predispose household members (normally low income earners) including the infants to respiratory and skin infections.

1.6 Significance of the study

The findings of the study will help planners in the planning, formulation and implementation of policy concerning the reduction of childhood mortality.

Also, this work will complement work already done in relation to childhood mortality and will guide persons in positions of designing programs to design programmes and policies towards improved health care for children.

The findings of the study will provide information about the wide spread of child mortality rate to stakeholders like the department of probation and child protection, Ministry of Labour and Social Development, Ministry of Health, National council for children, UNICEF, WHO and other NGO's whose beneficiaries are children so as to improve the quality of child care and their health.

1.7 Dissertation layout

This dissertation has been organised into 5 chapters. Chapter 0ne provides the background to the study in relation to the child mortality in the world and in Uganda particularly. The literature review on child deaths in relation to the objectives of the study is given in Chapter two. Chapter three focuses on study variables, sources of data and methodologies used in analysis. Chapter four presents the findings and the discussions of the findings. The background characteristics of the mothers and children with reference to the data set of UDHS 2006 were presented in chapter four. Also the effects of each selected variables from the two regression models were reported in this chapter. Lastly, chapter five summarises the entire study together with the conclusions of the study and also provides the research recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Many researchers have studied the various determinants of under-five mortality in the world and Uganda in particular. In this study, the emphasis was on the few maternal and socio-economic factors because they differ among the mothers. These are: mother's educational level, age, wealth index, and marital status and childhood factors like sex, birth-order, birth-weight and duration of breast feeding.

2.2 Maternal factors

The variables under study here are maternal age, marital status, maternal education, and household wealth.

2.2.1 Maternal age

Maternal age has been observed as an important predictor of child mortality. Studies have shown that adolescents and older mothers are likely to produce infants of low birth weights. These low birth weight infants have poor survival chances because the organs are small e.g. lungs and Kidneys especially those less than 2.5 kg. Ahonsi (1995) found that the risk of child mortality remained high to mothers in the teenage ages compared to those aged between 20 and 34 years.

Studies by Mohammed (1987), and Aizenmande (1988) have shown that IMR among children whose mothers are under 20 years of age is estimated at 126/1000 live births world over. Kibet (1987) indicated that there is an inverse relationship between the age of the mother and childhood mortality. Reichmann and Pagnini (1997) also found that the

relationship differs by race in the United States, with whites having a U-shaped relationship between the age of the mother and child mortality.

In Africa, people tend to engage in child bearing during their young ages (puberty) especially in rural areas. Once a girl reaches puberty, she is thought to be ready for marriage. They are under considerable pressure to start relationships by their parents or their guardians (Jackson, 2003). This can lead to higher incidence of mortality since there are no limits of bearing children once the girl has reached puberty stage.

In Uganda, a study conducted by Ahimbisibwe (1997) found a statistically significant relationship between childhood survival and age of the mother. This implies that having the birth too early increases the risk of infant death. Children born to older mothers (30 and above) in the study were found to have a higher risk of dying compared to those born to mothers in age group 25-30 years. Ayiga (1991) using data from the UDHS 1988/89 observed that infants born to mothers below 20 years were about two times at the risk of dying than those born to mothers aged 30-39 years. Ssekamatte Ssebuliba (1995) found that children born to young mothers are more likely to die than those born to older mothers.

2.2.2 Marital status

According to UNICEF (2003), it was revealed that births to mothers who had never been married had higher rates of child mortality. The reason for this was due to lower birth weights, which results from teenage mothers and women without previous birth. Carvajal and Burgress (1978) found that child deaths to children born to mothers who were living single lives were higher than those who were legally married.

Although there is an inverse relationship between women's status and early childhood mortality, the relationship is not necessarily linear (UBOS, 2001). The marital status of a mother in a family can determine her decision power (Muzamil et al, 2008) and this mother's decision-making power seems to have its greatest importance in influencing infant mortality. Among children whose mother has no final say in any decision, 131 in 1,000 died before celebrating their first birthday, compared with 93 or fewer in 1,000 among children whose mother participates in some decisions. Children's mortality level is associated with whether their mother has some power to make a final decision.

2.2.3 Maternal education

Wang (2002) and Basu et al (2005) noted the importance of mother's education on child survival. It reflects mother's level of knowledge and skills and the degree to which she can effectively make use of the resources at her disposal to increase survival chances of her infants.

Years of schooling (education of mother) was found to be significant in influencing child mortality. Mothers with zero years of schooling were more likely to have child death than those with some years of schooling (Girson et al, 2004). It is reported that in Nigeria "mothers with more education are less fatalistic about sickness and therefore tend to seek outside medical assistance for a sick child".

Women with more education increase their likelihood of securing steady, high paying employment, wield significant decision making power and control over resources (Frost et al 2005). Also women with authority are more likely to draw attention to their children's illnesses and to take a sick child to the health clinic (Caldwell 1993). Also it was indicated

that education equips women with great health knowledge (Bhuiya et al, 1990) and influences women attitude about health (Castro et al, 1995).

Education increases age at first marriage. A study by Akukunmi (1984), Cleland and Ginneken (1988), showed a negative effect of age at first marriage on the family size. It was found that educated mothers look for qualified medical personnel while seeking medical care for themselves and for children (Akukunmi, 1984). In Uganda, it was established that mothers who had primary and secondary education experienced fewer infant deaths (Chemisto, 1990). The reason was that education provides women with knowledge about risks involved in having children at young and older child bearing ages, short birth intervals and birth orders (Ayiga, 1991).

2.2.4 Household Wealth

In Bangladesh, it has been shown that children from poorer households tend to be more undernourished with increased risks of dying before 5 years of age than children in wealthier households (Zere et al, 2003). Also in a study by Mutunga (2004), it was indicated that wealth of household has a significant effect on the child survival. A child born to a mother from rich household has high risks of surviving up to at least five years of age.

According to UBOS (2006), employment is a source of empowerment for both women and men. It may be particularly empowering for women if it puts them in control of income. UBOS also reveals that in Uganda the employment level for women is higher in urban areas than in rural areas. This could be due to lack of education in rural areas. It is also indicated that wealth status is inversely associated with childhood mortality. For all measures, the

children in the highest wealth index quintile have the lowest mortality rates, while those in the lowest wealth index quintile have the highest mortality rates.

2.3 Childhood factors

2.3.1 Sex of child

Sex of child and child mortality has a positive correlation. It was indicated that socioeconomic differences in the risk of dying were greater among boys than girls and also that the socio economic differences reduced as boys and girls grew older (Nagero et al. 1989, Borja 1985). Considering the value of children; there is growing evidence that the sex of the child, commonly associated with fertility research, also contributes to child survival (Scrimshaw, 1978; Simmons et al., 1982). For example, in economic terms, a family's investment in child care may be conditional on expected returns. In Kenya, where girls are valued for the bride price, child survival rates are higher for females. And in South Asia, where female dowry is the main concern, the reverse is true (Mott, 1979; Poffenberger, 1981). However, studies have attributed higher female than male child mortality to differential feeding and medical care practices, while it was observed that some societies may resort to intentional injury (infanticide) to achieve family size composition goals (Chen et al, 1984).

In Uganda, Ssewanyana, (2005) showed that girls have a somewhat lower IMR than boys (seven per thousand), and each year of the mother's age at the child's date of birth lowers the IMR by 1.1 to 1.8 per thousand. Also mortality levels are consistently higher among male children than among their female counterparts. The difference ranges from 7 percent for post neonatal mortality to 14 percent for neonatal mortality (UBOS, 2001).

2.3.2 Birth weight

Low birth-weight has been defined by the World Health Organization (WHO) as weight at birth of less than 2,500 grams (5.5 pounds). This is based on epidemiological observations that infants weighing less than 2,500g are approximately 20 times more likely to die than heavier babies. More common in developing countries like Kenya, Uganda and Malawi than developed countries, a birth-weight below 2,500g contributes to a range of poor health outcomes (UNICEF, WHO, 2004).

According to Mosley (1984), a significant relationship of birth weight and weight for age as an indicator of general health was found to exist from prospective studies in Bangladesh, India, and New Guinea. Here measurements of cohorts of children below 3 years were taken at one point in time and the cohorts were followed prospectively for a period of one to two years. Mortality rates were calculated for age groups. The results showed a consistent increase in death risk with lower weight for age.

In Uganda, birth weight is a factor often associated with the child's survival, particularly during the first year (UBOS, 2001). It was shown that babies who were reported as small or very small at birth have higher mortality rates than those who were reported as average or large at birth. It was reported that 98 in 1,000 children of small size at birth died before age 1 while 84 out of 1,000 children born of average or large size died before age 1.

2.3.3 Birth Order

Usually the relationship between birth order and mortality at early age takes a U-shaped form. Mortality is high for first-born children and births of very high orders and is low for

births of order 2 or 3. Birth order and survival status of the preceding child have a strong association with infant mortality in Africa and Asia as well (Keonig, 1990).

In India, it was shown that birth order has an effect on child mortality which is higher for first and higher-order births. During these stages of children's development, mortality is more likely to depend on the care they receive than on biological factors. Children of high order births face competition from older siblings for food and parental attention. They also face exposure to infectious childhood diseases from their siblings. In addition, the mother's nutritional status, which affects birth weight and lactation, may decrease with high-order births (Norman et al, 1998). However, it is observed that in Bangladesh, neonatal and post-neonatal mortality level is the lowest for 4th and above order of births than first, second and third order of births (Kamal, 2009).

2.3.4 Duration of Breastfeeding

In 2001, the World Health Organization (WHO) changed its recommendation for exclusive breastfeeding from four to six months of age. Before deciding to align with this recommendation, Health Canada carefully considered the evidence presented by WHO along with other recent information of relevance in a Canadian context. Exclusive breastfeeding for six months confers additional protection against gastrointestinal infections. Healthy term infants who are exclusively breastfed for six months grow at similar rates and show similar iron status as infants who are exclusively breastfed for three to four months and then continue partial breastfeeding to six months. Other health outcomes related to six months versus four months of exclusive breastfeeding ware examined, and the results have been inconclusive, insufficient or have not shown substantial differences.

Increasing the duration and exclusivity of breastfeeding could save an estimated 1.5 million infant lives each year. Fifty five percent of infant deaths from diarrhoeal diseases and acute respiratory infections may result from inappropriate feeding practices (UNICEF, 1999). This was also noted in study by Jamal (2009). It also revealed that the initiation of breastfeeding within the first hour of life, exclusive breastfeeding for the first 6 months, timely and adequate complementary feeding, and continued breastfeeding for 2 years and above are some of the feeding practices that can improve children's health especially in developing countries

Infants who were partially breastfed or not breastfed had a risk of diarrhoeal death more likely than exclusively breastfed infants. The risk of death due to diarrhoea among predominantly breastfed infants was also higher but not statistically different from that of exclusively breastfed infants (Jason et al, 1984).

2.4 Intermediate factors

2.4.1 Water sources and sanitation

WHO (2002) reports that among the ten identified leading mortality risks in high-mortality developing countries, unsafe water, sanitation and hygiene ranked second, while indoor smoke from solid fuels ranked fourth. About 3 per cent of these deaths (1.7 million) are attributable to environmental risk factors and child deaths account for about 90 per cent of the total.

Toilet and quantity of water are essential attributes for a clean environment that determines childhood mortality (Wang, 2002). Treating it with chemicals or boiling can improve the quality of water. Poor sanitation in homes is the root cause of diarrhoea, dysentery, cholera and stomach worms. Rowland (1979) said that transmission of infectious diseases in Africa is

through unsafe water supply and poor toilet facilities that contribute to the contamination of traditional weaning foods.

A study conducted among 5 countries including Uganda by Fuentes et al, (2006), found strong evidence that both interventions, improvements in water and sanitation, have a significant effect on mortality decline. In related areas of sanitation, they estimated the effect of having a pit latrine on the chances of child survival at 40% for both the whole country and the rural areas.

In Uganda, people in rural areas depend on rivers, lakes, and springs as sources of water. This is supplemented by health education in line with handling drinking water by boiling and keeping such water in clean containers. However, some areas (rural) in Uganda are not reached by the health educators and therefore continue to drink unboiled or contaminated water.

2.4.2 Immunisation

Immunization coverage does not have a strong correlation with the persistent trend in child mortality in Uganda (Okella, 2009). However, one could also conclude that the reduction in child mortality in the country over the years could partly be attributed to the wider coverage of immunization. On balance, this study by Okela, concludes that the level of immunization coverage does not explain the persistent trend in child mortality in the face of economic growth in Uganda over the years.

In a report by WHO (2001), the immunization coverage target for the year 2005 was set at 80%, however in Uganda it is still considered to be low. Some of the probable reasons behind

this could be (1) Communities have not internalized the usefulness of immunization and benefits of completing the full doses for children. (2) health workers do not inform or remind mothers/ guardians to come back for more doses and outreach dates. (3) immunization sessions sometimes conflict with farming/family. (4) little involvement of local leaders, especially in following up of defaulters

Bangladesh prepared three National Plans of Action (NPA) in 1990, 1999 and 2005 to fulfill its commitment to children. Although Bangladesh has had remarkable success in immunization coverage, a gap still exists between urban and rural areas. According to the 2005 EPI Coverage Evaluation Survey, the full immunization rate with valid doses was 68% in urban areas and 63% in rural areas. In rural Bangladesh, while four out of five children are receiving at least one of the recommended vaccinations, only three in five are being fully immunized (Mosiur, 2009). It was shown that immunization or vaccination coverage have a significant effect on reducing IMR in rural areas (Wang, 2002)

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter explains the sources of data, variables used, study area, data processing, methods and levels of analysis that were used.

3.2 Data Source and Processing

Data from the Uganda Demographic and Health Survey were used in this study. The study covered the whole of Uganda. From the data, information about the children and their mothers who were born 5 years before the survey (2006) was obtained. The cleaning together with coding was done so as to remain with variables of interest. This data was transformed into the required information using STATA software.

3.3 Study Variables

The dependent variable was childhood survivorship; the variable gave a binary outcome; a child born survived to the 5^{th} birth-day; coded zero (0) or died before his/her 5^{th} birth-day, coded one (1) and this was the outcome of a question whether a child born alive had died before or survived up to 5 years of age. The independent variables included; sex of the child, birth weight, birth order, and duration of breastfeeding as child level factors; education level, household wealth, age of the mother and marital status as mother level factors.

3.4 Data analysis

STATA (10.0) statistical package was used in data analysis. This data analysis was done in three steps.

At univariate analysis, descriptive statistics were presented for the selected independent variables; this was mainly to explore each variable separately. Frequency distribution tables were constructed to show the distribution of each variable in the study.

At bivariate level of analysis, presentation of the proportion of children who died and those who survived by background characteristics at both unit of level of analysis were done. Testing for associations, between two variables was done using the chi-square.

This is the general form of a Chi-square, that was used,

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{c}\frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

Where; j=1, 2… c.

i=1, 2… r

O_{ij} = Observed frequency (observed number of children).

E_{ij} = Expected number of children dead.

c = Number of categories of the dependent variable.

r = Number of categories of the independent variable.

At multivariate level of analysis**,** the analysis determined how each independent variable affects the dependent variable (childhood survivorship). The multilevel mixed effects logistic regression was fitted to determine the effect of the covariates on childhood mortality; the mixed-effects logistic model became relevant in this analysis as the outcome variable in this analysis was a binary outcome indicating whether a child survived up to the fifth birthday or not and that the demographic and health survey data normally used for child mortality analysis have a hierarchical structure. The assumption in this analysis was that the risk of death for children of the same family tends to be similar due to the common family environment. Similarly, family characteristics, child rearing behaviour, health facilities and

economic development all of which have an effect on child survival are more similar in one family.

The model was fitted for the existence of a relationship between the dependent and the independent variables. The independent variables used at this level of analysis were those variables, which showed strong association with childhood mortality at bivariate level of analysis where p value was less than 0.05.

The ratio of the probability that the child died before age 5 to the probability that the child did survive up to age 5 (An odds ratio) was used as an indicator of the risk of a child death relative to the reference category of the variable.

Multilevel analysis is a general term referring to statistical methods appropriate for the analysis of data sets comprising several types of unit of analysis. The levels in the multilevel analysis are another name for the different types of unit of analysis.

As mentioned above, the outcome variable is a binary outcome; therefore a hierarchical or multilevel mixed effects logistic regression (Random effects model) was used in the analysis.

For the i^{th} observation in the j^{th} mother, we observe a dichotomous response:

Y_{ij} = 1, for a child who survived up to at least 5 years

0, otherwise.

We assume that Y_{ij}/P_{ij} = Bernoulli (P_{ij}) …….. (3.0)

Independently for i= 1, 2 … n_j and j= 1, 2, 3 ….N, where

P_{ij} =Pr (Y_{ij} =1) is the probability that i^{th} observation (child) will not survive up to at least 5years of age.

Therefore, for the j^{th} mother, the usual logistic regression will be:

$$\text{Logit}(P_{ij}) = \log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_0 + \beta_{ij} x_{ij} + \ldots + \beta_{kn} x_{kn} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.1)$$

Where; x_i are independent variables.

β_0 is a constant.

β_i are unknown coefficients of each x_i.

P_{ij} is the probability that a new borne baby will survive up to his/her 5^{th} birth-day

Assume there are j = 1,..., N mothers (level-2 units) and i = 1,...,n_j repeated observations (level-1 units) nested within each subject (mother). A random-effects regression model, which is the simplest mixed model, augments the linear predictor with a single random effect for the jth mother (McCullagh and Nelder, 1989) will be:

$$\text{Logit}(P_{ij}) = \log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \mathbf{X}_{ij}\boldsymbol{\beta} + \mathbf{V}_j + \mathbf{e}_{ij} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.2)$$

Where

$\mathbf{X}_{ij}$ = the covariate matrix (includes a 1 for the intercept),

$\boldsymbol{\beta}$ = the vector of unknown regression parameters,

$\mathbf{V}_j$ = the random cluster effect (one for each level-2 cluster i.e. mother)

$\mathbf{e}_{ij}$ = the error term

$\mathbf{V}_j$ the random effect (one for each mother). These random effects represent the influence of j-th mother on her repeated observations (children) that is not captured by the observed covariates. These are treated as random effects because the sampled subjects (mothers) are thought to represent a population of subjects (mothers).

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF FINDINGS

4.0 Introduction

This chapter discusses the findings of the study at different levels of analysis; showing the distribution of respondents by some selected characteristics of children and mothers, the associations between the independent variables and dependent variables and also at multivariate level which established the effect of each variable.

4.1 Distribution of Mothers by their Characteristics

4.1.1 Age of the Mother

Table 4.1 shows that 41 percent of women were under the age group of 20-29 followed by 33 percent under the age group of 30-39. Further, 20 percent of women were in the age group 40-49 and the least 6 percent of women in the age group 15-19. This indicated that at least 74 percent of the reproductive women were 20 years and above but less than 40 years of age while 26 percent of the reproductive women were below 19 years or 40 and above years.

4.1.2 Household Wealth

Household wealth was referred to as how rich or poor the mother's family/household was. As indicated in the Table 4.1, household wealth was categorised in three groups; poor, middle, and rich families. It was observed that 43 percent of women were from poor families, followed by 39 percent of women considered to be from the rich class while 18 percent were from the middle class families. This showed that majority of the mothers were from poor families. This is in support of the situation in developing countries like Uganda where it is established that most of the families fall within the poor class families.

Table 4.1; Percentage distribution of respondents by mother level factors

Variable	Frequency	Percentage
Age of mother		
15-19	367	5.7
20-29	2,630	41.0
30-39	2,136	33.3
40-49	1,284	20.0
Total	**6,417**	**100**
Household Wealth		
Poor	2,755	42.9
Middle	1,158	18.1
Rich	2,504	39.0
Total	**6,417**	**100**
Education level		
No education	1,645	25.6
Primary	3,751	58.5
Secondary	826	12.9
Higher	195	3.0
Total	**6,417**	**100**
Marital status		
Never married	271	4.2
Married/cohabiting	5,086	79.3
Divorced/Separated	1,060	16.5
Total	**6,417**	**100**

4.1.3 Education level attainment

It is indicated that education equips women with great health knowledge (Bhuiya et al, 1990) and influences women attitude about health (Castro et al, 1995). However, Kyayonka (1993) found the contrary that highly educated mothers experience high mortality due to early winning of their children.

In this analysis, education was coded in four categories. From Table 4.1, at least 58 percent of women had attained primary level of education, 26 percent of women had never gone to

school, and 13 percent of women had attained secondary level while only 3 percent of women had gone to higher institutions of learning. Further, at least 16 % of women had attained secondary level and above, evidence that women were not highly educated.

4.1.4 Marital status

Table 4.1 shows that at least 79 percent of women were married, 17 percent were never married while the minority 4 percent of women were divorced/Separated. This shows that, of the total women that were considered, the big percentage of them was married.

4.2 Distribution of Children by their Characteristics

4.2.1 Birth weight

Birth weight is a factor often associated with the child's survival, particularly during the first year (UBOS, 2001). Table 4.2 shows that 45 percent of children born were reported as of average size at birth, 33 percent were reported as of large size, and 22 percent of children born were reported as of small size. This means that most born babies were of small or average size at birth. This could be an indication that in developing countries, mothers are not aware of the effect of the size of a child at birth on the survival of a child. This is attributed to the fact that from the study some mothers were unable to give information pertaining to the size of their children at birth.

Table 4.2: Percentage distribution of respondents by child level factors

Variable	Frequency	Percentage
Sex of child		
Male	4,145	49.5
Female	4,224	50.5
Total	**8,369**	**100.0**
Birth weight		
Large	2,723	32.6
Average	3,761	45.1
Small	1,860	22.3
Total	**8,344**	**100.0**
Duration of breastfeeding		
Up to 2 years	7,261	87.4
More than 2 years	653	7.8
never breastfeed	396	4.8
Total	**8,310**	**100.0**
Birth order		
1and 2	2,649	31.6
3 and 4	2,190	26.2
5+	3,530	42.2
Total	**8,369**	**100.0**

4.2.2 Duration of Breastfeeding

UN (2003) showed that child immunization and exclusive breast-feeding programmes reduce child mortality. Table 4.2 above, showed that 87 percent of the children born alive were breastfed up to 2 years, 8 percent were breastfed for a period of more than 2 years, while 5 percent of children born were never breastfed at all.

4.2.3 Birth order

The majority of the children were of birth order 5 and above followed by those of order 1and2. Table 4.2 showed that 42 percent of the total children born were of birth order 5 and above, 26 percent were of birth order 3and4 while 32 percent of children born were of birth order 1and2.

4.2.4 Sources of clean drinking water

UNICEF (1997) reported that improved water supply does not only reduce diseases but also saves time in water collection. In this study, source of water was categorized as; protected source (boreholes, protected springs, piped water) and unprotected source (open sources like lakes, rivers and springs). Table 4.3 shows that 60 percent of mothers had access to clean water from protected sources while 40 percent used water from unprotected sources. It should be noted that using water from protected sources does not mean health. Emphasis should therefore be put on safe handling and storage of this water from protected sources.

Table 4.3 Percentage distribution of respondents by intermediate factors

Source of drinking water	**Frequency**	**Percentage**
Unprotected source	3,339	39.9
Protected source	5,023	60.1
Total	**8,369**	**100.0**
Toilet Facilities		
No toilet	2,352	28.1
Uncovered toilet facility	4,762	56.9
Covered toilet facility	1,255	15.0
Total	**8,369**	**100.0**
Ever had Immunization		
Yes	5,005	59.8
No	3,364	40.2
Total	**8,369**	**100.0**

4.2.5 Toilet facilities

UBOS (2006) revealed that households without proper toilet facilities are more prone to the risk of diseases like dysentery, diarrhoea and typhoid fever than those with improved sanitation facilities.

From Table 4.3, 57 percent of mothers use uncovered toilet facilities, 28 percent have no toilets to use at all while 15 percent could use covered toilet facilities. This meant that at least 85 percent of mothers with their children had no or do not expose their human waste in a proper way which may be a health risk to both children and their mothers.

4.2.6 Accessibility to immunization services

The study indicated that the majority of the children were immunized with 60 percent of mothers having reported that their children had ever received vaccinations against killer diseases, including national immunization campaigns while 40 percent reported that their children had never received vaccinations, including national immunization campaign. This may be risky for children's health against the immunizable diseases.

4.3 Relationship between the dependent variable and one selected independent variable

In order to find out the relationship of each of the independent variables on the childhood survivorship, cross tabulations were done. The chi-square statistic was used as a measure of associations.

4.3.1 Child factors

This section shows the association between the child characteristics and child mortality. These include sex of the child, birth weight, birth order, and duration of breastfeeding.

4.3.1.1 Sex of a child

The study revealed that more childhood deaths occurred among males compared to their female counterparts. From Table 4.4, 10 percent of male children born alive died before age 5 compared to 8 percent of female children born alive who died before age 5. It could be seen that sex is one of the determinants of child mortality in Uganda. The chi-square statistic showed a significant association between childhood death and sex ($p=0.000$).

4.3.1.2 Birth weight

From the study, childhood death was found to be high among children who were born with small size. It is hypothesized that children born with large sizes at birth have high chances of

surviving up to at least 5 years of age compared to others. Table 4.4 showed that 11 percent of the children born when small died before age 5 compared to 9 percent of the children born when large who died before age 5. Also 8 percent of the children born when they are of average size at birth died before age 5. This showed that children born alive with small size were at high risks of dying before 5 years of age. The chi-square statistic indicated a strong significant relationship between childhood death and birth weight (p=0.003).

4.3.1.3 Duration of Breastfeeding

From this study, results showed that duration of breastfeeding had a relationship to childhood mortality. From Table 4.4, 58.8 percent of children who were never breastfed died before age 5 compared to 0.9 percent of children who were breastfed for a period of more than 2 years and died before age 5. It was also indicated that 7 percent of the children who were breastfed up to 2 years died before age 5. This shows that child mortality was mostly high in children who were never breastfed.

The chi-square statistic showed a significant relationship between childhood mortality and duration of breastfeeding (p=0.000).

4.3.1.4 Birth order

Table 4.4 shows that at least 9 percent of children of birth order 5 and above died before age 5 compared to 9 percent of children of birth order 1&2 who died before age 5. Also 9 percent of children of birth order 3&4 born alive died before age 5. However, the chi-square statistic indicated that there was no significant relationship between childhood mortality and birth-order (p=0.309).

Table 4.4: Relationship between the dependent variable and selected child level characteristics

Variables	Number of children	Number dead	% dead
Sex of child			
Male	4,145	431	10.4
Female	4,224	345	8.2
χ^2 =12.3718, pr=0.000, df=1			
Birth weight			
Large	2,723	243	8.9
Average	3,761	316	8.4
Small	1,860	207	11.1
χ^2 =11.4189, pr=003, df=2			
Duration of breastfeeding			
Up to 2 years	7,261	520	7.2
More than 2 years	653	4	0.9
Never breastfeed	396	233	58.8
χ^2 =0.374, pr=0.000, df=2			
Birth order			
1&2	2,649	243	9.2
3&4	2,190	200	9.1
5+	3,530	333	9.4
χ^2 =0.1908, pr=0.309, df=2			

4.3.2 Mother factors

4.3.2.1 Age of the mother

Ahimbisibwe (1997) found that age of the mother has an effect on childhood mortality and that it is high among children born to younger and older mothers. Table 4.5 showed that 12 percent of the children born to mothers in age group 40-49 died before age 5 compared to 8 percent of children born to mothers in age group 15-19 who died before age 5. Also 9 percent of children born to mothers in age group 20-29 died before age 5 compared to at least 9

percent of children born to mothers in age group 30-39 who died before age 5, which is in agreement with the findings by Ahimbisibwe (1997). The relationship between childhood mortality and age of the mother was found to be significant (p=0.017).

4.3.2.2 Education of the mother

The study revealed that childhood mortality is high among children born to mothers with no education compared to those children born to mothers with some level of education. Table 4.5 shows that 10 percent of children born to mothers with no education level died before age 5 compared to 5 percent of children born to mothers with higher (higher institutions) level of education who died before age 5. Also it is indicated that 10 percent of children born to mothers with primary level of education died before age 5 compared to 7 percent of children born to mothers with secondary level of education who died before age 5. There was a significant relationship between education level of the mother and childhood survivorship as indicated in table 4.4 (p=0.001).

4.3.2.3 Marital status

The study revealed that births to mothers who are divorced/separated had higher rates of child mortality. Table 4.5 showed that 12 percent of children born to divorced/separated mothers died before age 5 compared to 9 percent of children born to married/cohabiting women who died before age 5. However, 7 percent of children born to unmarried women died before age 5. The chi-square statistic shows a significant relationship between childhood mortality and marital status (p=0.009).

Table 4.5: Relationship between the dependent variable and selected mother level characteristics

Household wealth	Number of children	Number dead	%dead
Poor	3959	407	10.3
Middle	1555	132	8.5
Rich	2855	237	8.3
χ^2 =9.1175 Pr=0.010, df=2			
Marital status			
Never married	262	17	6.5
Married/cohabiting	7236	656	9.1
Divorced/Separated	871	103	11.8
χ^2 =9.5295 Pr=0.009, df=2			
Education level			
No education	2034	210	10.3
Primary	5181	494	9.5
Secondary	959	63	6.6
Higher	195	9	4.6
χ^2 =16.4567, Pr=0.001, df=3			
Age of the mother			
15-19	430	33	7.8
20-29	4357	411	9.4
30-39	2885	247	8.6
40-49	697	85	12.2
χ^2 =10.2495 Pr=0.017, df=3			

4.3.2.4 Household wealth

The study revealed that childhood death was high among children born to mothers from poor families. Table 4.5 shows that 10 percent of children born to mothers in poor families died before age 5 compared to 8 percent of the children born to mothers in rich families who died

before age 5. Also 9 percent of children born to mothers in middle class families died before age 5. It was indicated from the chi-square statistic that the relationship between the household wealth of a mother and childhood mortality was significant (p=0.010).

4.3.3 Intermediate factors

4.3.3.1 Toilet facilities

Results from the study indicate that 18 percent of the children born to mothers without toilet facilities died before age 5 compared to 10 percent of children born to mothers with covered toilet facilities who died before age 5. And 16 percent of children born to mothers with uncovered toilet facilities died before 5 years of age. This meant that human waste disposal contributes much to child mortality rate. The chi-square showed a significant relationship between toilet facilities and child mortality (p=0.004).

4.3.3.2 Accessibility to Immunization Services

Immunization is a key ingredient in helping children to get the attainable standard of child health through preventing the six killer diseases like polio, T.B, measles etc. This can be achieved through improved routine immunization and supplemental campaigns that give children a second opportunity to be immunised.

From Table 4.6 below, results show that 11 percent of the children who were immunized against the six killer diseases died before 5 years of age compared to 14 percent of the children who were not immunized against the six killer diseases who died before 5 years. However, the chi-square showed no significant relationship between immunization and child mortality (p=0.201).

Table 4.6: Cross tabulation of childhood mortality by intermediate variables

Source of drinking water	number of children	number dead	% dead
Unprotected source	3,523	627	17.8
Protected source	4,846	741	15.3
χ^2 =0.0145, p=0.035, df= 1			
Toilet Facilities			
No toilet	2,812	512	18.2
Uncovered toilet facility	4,444	724	16.3
Covered toilet facility	1,113	112	10.1
χ^2 =23.0451,p=0.004, df= 2			
Ever had Immunization			
Yes	5,005	571	11.4
No	3,364	464	13.8
χ^2 =0.04531,p=0.201, df= 1			

4.3.3.4 Source of drinking water

In Table 4.6, the majority of the children were born in families with protected source of drinking water. This reduces their risk of getting diseases associated with contaminated water. Table 4.6 shows that 15 percent of the children born to mothers with access to protected water sources died before age 5 compared to 18 percent children born to mothers with unprotected water sources who died before age 5.

4.4 Determinants of child death

In order to establish the effect of each independent variable (factor) on childhood deaths in Uganda, a random effects regression model was fitted due to the type of data (nested data) used.

4.4.1 Sex of child

Sex of a child showed a statistical significant relationship against child mortality. Female children had reduced risks of dying before 5 years of age compared to male children (OR=0.81832, pr=0.017). This could be due to differences in childhood mortality in children by sex i.e. male children have high mortality than females. Culturally, female children are considered to be of great importance since they are regarded as a source of wealth at marriage. Hence parents show much care to females than male children. This is similar to what happens elsewhere, for example in Kenya, where girls are valued for the bride price, child survival rates are higher for females, Mott (1979) and Poffenberger (1981).

4.4.2 Education level attained

In literature, mothers who had primary and secondary level of education experienced fewer infant deaths. In this study, children born to a mother of secondary level had reduced risks of dying before 5 years of age compared to children born to mothers with no education (OR= 0.6802, p=0.023). Also children born to mothers with higher level of education had reduced risks of dying before 5 years of age compared to children born to mothers with no education (OR= 0.3723, p= 0.016). This could be possible because a woman with some level of education of at least secondary level may be aware of the diseases caused by contaminated water thus able to use protected clean water, give good health care, get a job and be able to support the family in terms of basic needs of life. Also education equips women with great health knowledge (Bhuiya et al, 1990) and influences women attitude about health (Castro et al, 1995).

4.4.3 Duration of Breastfeeding

In this study, duration of breastfeeding showed a statistical significant effect to childhood mortality. Children breastfed for a period of more than 2 years had reduced risks of dying before 5 years of age compared to children who were breastfed for less or up to 2 years (OR=0.0856, P=0.000). Children that were never breastfed had increased risks of dying before 5 years of age compared to children who were breastfed for less or up to 2 years (OR=44.5142, P=0.000). This could be possible because a child will not be getting more nutrients for her or his body building. These nutrients are supposed to support what the child gets from other foods and drinks. Therefore, children with lack of such nutrients may have increased risks of dying before 5 years of age compared to their counterparts, which is in agreement with the study by Ebrahim (1979).

4.4.4 Birth weight

Birth weight was found to be significant to child mortality. Children born when small had increased risks of dying before 5 years of age compared to children born when large (OR=1.2525, P=0.041). This could be due to premature birth (being born before 37 weeks of gestation) meaning a baby has got less time in the mother's uterus to grow and gain weight or because of problems with the placenta, the mother's health or birth defects. All these might lead to premature and weak born babies posing high risks of death among children. Also poor maternal food supplements given to mothers during pregnancy might also lead to premature and weak born babies since child malnutrition is increasingly recognized to be largely determined during the period when the child is still inside and infant growth, when maternal nutrition has its strongest influence. This is in agreement with studies by Mosley (1984) and UBOS (2001).

Table 4.7: Results from regression models: The random effects and standard logistic (binary) regression models.

Model I **Random effects model**				**Model II** **Standard logistic regression model**		
Variables	**Odds ratio**	**Std.Error**	**P-value**	**Odds ratio**	**Std.Error**	**P-value**
Sex						
Male	1			1		
Female	0.8183	0.0688	0.017	0.7554	0.0585	0.000
Birth weight						
Large	1			1		
Average	0.9105	0.0885	0.335	1.2842	0.1327	0.015
Small	1.2525	0.1378	0.041	2.0491	0.7293	0.044
Duration of breast feeding						
≤ 2	1					
> 2	0.0856	0.0505	0	0.7521	0.7763	0.006
Never breast feed	4.5142	3.2639	0	2.5309	0.7172	0.001
Age of mother						
15 - 19	1					
20 - 29	1.1527	0.2431	0.005	1.1163	0.2725	0.058
30 - 39	0.0943	0.2197	0.034	0.7348	0.2296	0.040
40 - 49	1.5702	0.3832	0.012	1.2123	0.2621	0.460
Education level						
No education	1					
Primary	1.0115	0.1045	0.912	0.9864	0.0921	0.883
Secondary	0.6802	0.1229	0.023	0.6871	0.1137	0.033
Higher	0.3723	0.1532	0.016	0.4839	0.1736	0.042
Household wealth						
Poor	1					
Middle	0.7834	0.0932	0.032	0.7952	0.0368	0.046
Rich	0.8462	0.0881	0.041	0.8953	0.0841	0.042
Random-effects parameters	**Estimate**	**Std.Error**				
Caseid: Exchangeable						
Sd.	0.38978	0.062164				
Corr.	0.999994	0.011251				

4.4.5 Age of the mother

From Table 4.5, children born to mothers in age group 30-39 had reduced risks of dying before 5 years of age compared to children born to a mother in age group 15-19 (OR= 0.0943, p=0.034). Also children born to a mother in age group 40-49 had increased risks of dying before 5 years of age compared to children born to mother of age group 15-19 (OR= 1.5702, P=0.012). This could be because adolescents and older mothers are likely to produce children of low birth weight which increases the risk of child death. This finding corroborates the works of Ahimbisibwe (1997). Further, children born of older mothers (30 and above) in the study were also found to have a higher risk of dying.

4.4.6 Household Wealth

Household wealth showed a statistical significant relationship with child survival. From table 4.5, children born to a mother in a rich family had reduced risks of dying before 5 years of age compared to children born to a mother in a poor family (OR= 0.8462, P=041). Also children born to a mother in a middle class family had reduced risks of dying before 5 years of age compared to children born to a mother in a poor family (OR= 0.7834, P=0.032). This is in conformity with the study done by Zere et al (2003) in Bangladesh; the study indicated that children from poor households tend to be more undernourished with increased risks of dying before 5 years of age than children in wealthier households. This could be because mothers from rich families can afford basic requirements such as protected source of water, medical care and sufficient food/nutritional requirements needed for proper child health than those children of mothers in poor families who are unable to provide the basic needs.

4.4.7 Random effects

From the study, a significant relationship between-mother random variation was found [σ=0.3898]. Having controlled for mother level factors, the within childhood characteristics were found to be highly correlated (on average 0.999). This means that mortality rates of children are highly influenced by mother level characteristics. It is likely there are other biological or precipitating/prognostic factors affecting mortality differently in different mothers. This variation could be possible because mothers can be of the same age group but staying in different areas and having different standards of living or be in same age group but having different education levels which may bring different understanding (knowledge) about the health of a child. Using an explicit multilevel analytic framework, the study has demonstrated that individual (child) and mother level characteristics are independent predictors of child mortality, and that there is significant variation in odds of reporting child mortality, even after controlling for effects of both individual- and mother-level characteristics which would not be seen by using the standard logistic regression model.

4.5. Interpretation of results by a standard Logistic (binary) regression model

Table 4.7 gives results as by model II. Variables; Age of Mother, Education level, household wealth, duration of breastfeeding, birth-weight and sex had significant relationships with child mortality. These results are almost the same as the results by model I. However, the p - values in the model I are small compared to the p – values of model II. This would mean that the variables in model I are more statistically significant than those in logistic model. This could be because the standard logistic model does not cater for the variation in mortality rates due to hierarchical structure in the data.

CHATER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

The main objective of the study was to examine the factors associated with child mortality in Uganda using a hierarchical or multilevel regression model and more specifically examining the effect of childhood factors and the contribution of mother factors on child mortality in Uganda. Variables under study had a significant association with childhood mortality except birth-order, source of drinking water, and immunisation which were not significant.

5.1 Summary

The study examined the effect of childhood factors and contribution of mother characteristics on childhood survivorship in Uganda. The study used secondary data from Uganda Demographic and Health Survey data (UBOS, 2006). The analysis was done at three different levels of analysis. At regression analysis, a random effects regression model was used to obtained the results

Most of the women were under the age group of 20-39 and most of which came from families whose household wealth was considered to be poor. This is in support of the situation in developing countries like Uganda where it is established that most of the families fall within the poor class families. About 74% of the women had attained some level of education with 7% of them had never been married. Most of the children were females and most children were found to been breastfed up to 2 years.

Variables like sex, birth weight, breastfeeding, age of the mother, education level, marital status, household wealth, toilet facilities showed a significant relationship with child mortality. Sex of a child, duration of breastfeeding, birth weight, Education level, age of mother, household wealth were found to be important predictors of child mortality. However, controlling for mother level factors, the within childhood characteristics were found to be highly correlated. This means that mortality rates of children are highly influenced by mother level characteristics. It is likely that there are other biological or precipitating/prognostic factors affecting mortality differently in different mothers. Using an explicit multilevel analytic framework, the study demonstrated that individual (child) and mother level characteristics are independent predictors of child mortality, and that there is significant variation in odds of reporting child mortality, even after controlling for effects of both individual- and mother-level characteristics which would not be seen by using the standard logistic regression model.

Results as by the Standard Logistic regression model were almost the same as the results by the random effects model. However, the p - values in the random effects model were small compared to the p – values of a standard logistic model. This meant that the variables in the random effects model are more statistically significant than those in logistic model because the standard logistic model does not cater for the variation in mortality rates due to hierarchical structure in the data.

5.2 Conclusions

The study looked at the factors associated with childhood mortality in Uganda and an in-depth analysis was taken to determine which level variables tend to put children at higher risks of death. Using a random effects regression model as an example of hierarchical model

and the standard logistic regression model, the results obtained were almost of the same conclusions. However, their p-values were different.

Variables like sex of child, birth weight, breastfeeding, age of the mother, education level, marital status, household wealth, toilet facilities showed a significant relationship with child mortality at bivariate analysis level.

Using a random effect model, Sex of a child, duration of breastfeeding, birth weight, Education level, age of mother, household wealth were found to be important predictors of child mortality. However, the within childhood characteristics were seen to be highly correlated. This means that mortality rates of children are highly influenced by mother level characteristics. It is likely that there are other biological or precipitating/prognostic factors affecting mortality differently in different mothers. The study demonstrated that individual (child) and mother level characteristics are independent predictors of child mortality, and that there is significant variation in odds of reporting child mortality, even after controlling for effects of both individual- and mother-level characteristics which would not be seen by using the standard logistic regression model.

Results as by the Standard Logistic regression model were a bit different from the results by the random effects model. The p - values in the random effects model were small compared to the p – values of a standard logistic model. The variables in the random effects model are more statistically significant than those in a standard logistic regression model due to lack of independence of variables in the standard logistic regression model the model or variation in mortality rates due to hierarchical structure in the data.

5.3 Recommendations

In a concept from an explicit multilevel analytic framework, the study demonstrated that individual (child) and mother level characteristics are independent predictors of child mortality, and that there is significant variation in odds of reporting child mortality, even after controlling for effects of both individual- and mother-level characteristics which would not be seen by using the standard logistic regression model. Variables in the random effects model are more statistically significant than those in a standard logistic regression model. Therefore the researcher recommends the following:

The researcher recommends that random effects model should be used when demographic and health survey data are used for child mortality analysis due to their hierarchical structure of the data. This is because multilevel modelling has the advantage of taking the hierarchical structure of such nested data into account.

Efforts are needed to extend educational programmes aimed at educating mothers on the benefits of exclusive breast feeding, improvement in maternal health services, together with services targeting children from the poor families that cannot afford basic needs should be put in place. This is the responsibility of the government through the line ministries, NGOs and Local government.

Also Educational programmes aimed at creating public awareness especially those that are related with child survival should be put in place targeting parents, religious leaders, and other opinion leaders like local council members. The best approach here should be participatory guided discussions in preference to formal lectures. This may take place at community level, say local council meetings and religious congregations or at health centres for pregnant mothers.

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